This problem was first solved by Alhazen, a learned Arabian of the 11th century, and published at Basle, in Latin, in 1572. Since that time it has been studied by several distinguished mathematicians and a variety of solutions given. The paper presented contained a collection of these solutions aiming to be complete. Eleven solutions were contained in this collection, beginning with Alhazen and ending with a solution by E. B. Seitz, in 1881.

The first five solutions are by geometrical constructions, in which the points sought are determined by the intersections of a circle and hyperbola. The sixth solution, also a geometrical construction, is by means of the intersection of a circle and parabola. The seventh, eighth, ninth and eleventh solutions are by analytical or algebraical methods, while the tenth is a trigonometrical solution.

Among the people who have studied and solved the problem are Alhazen, Barrow, Hutton, Huyghens, Kaestner, Leybourn, L'Hospital, Robins, Seitz, Sluse and Wales. A complete list of bibliographical references was appended to the paper.

The paper contained further, an extension of the problem, *first*, to the surface of a sphere, and *second*, to an ellipse. The first case was illustrated by the following practical example:

The great circle track between San Francisco, Cal., and Yokohama, Japan, reaches nearly to latitude 52° N. The Pacific mail steamers plying between these ports usually avoid going north of latitude 45° N. Now, if the 45th parallel of latitude be designated as one north of which the steamer is not to go, in what longitude must this parallel be reached in order that the steamers' path between the ports shall be the shortest possible? The extension of Alhazen's problem to the surface of the sphere solves this problem and the longitude required is 168° W. from Greenwich.

The extension of the problem to the case in which an ellipse replaces the circle gives rise to a very complex equation of no special value.

WASHINGTON, D. C., Sept. 13, 1881.

ROTATION OF REDUCING POWER, AS MEASURED BY FEHLING'S SOLUTION TO THE ROTATORY POWER OF COMMERCIAL AMYLOSE (GLUCOSE AND GRAPE SUGAR).

SECOND PAPER.*

By PROF. H. W. WILEY, Lafayette, Ind.

In a paper read at the Boston meeting of this Association [1] I called attention to the fact that the reducing power of Amylose, measured by Fehling's Sol., could be readily determined by the polariscope. Since that time I have extended the series of observation then reported, and with such results as justify the conclusions at which I arrived.

In commercial Amyloses, whose specific gravities do not vary much from 1.410, the reducing power is reliably calculated from the reading of the polariscope. The average percentage of water in these Amyloses is nearly thirteen. If we allow one per cent for optically inactive substances present, we may safely place the optically active matter at 86 per cent. By prolonged boiling with acids, even if they be quite concentrated, only about 82 per cent of reducing matter is obtained.[2] Further boiling causes the mass to turn brown, and may even cause a decrease in the amount of reducing matter found. Since there is so much difference of opinion respecting the reliability of Fehling's solution, and since there is no other reducing mixture that works as well, it would, perhaps, be better to use the polariscope for the determination of the amount of substances present in an Amylose capable of reducing the various solutions used for grape sugar measurements

In the following table the calculation of the reducing power was made by the formulæ,[3] which I have already explained. Although, in a few cases, the specific gravity varied by a few thousandths from 1.410, the difference has not been of sufficient importance to make any correction[4].

Since the ordinary Amyloses, called grape sugars, of commerce differ from those called glucoses only in having the processes of conversion carried further, it is found that the same rule applies to them also. In fact, I believe it will be found true with all varieties of Amylose made by use of sulphuric acid, provided 8.6 grammes of the anhydrous substance be used in each 100 c.c. of the mixture to be examined.

Following are the results of my observations:

TABLE I.

No.	Sp. gravity.	Reducing matter by Fehling's Solution.	Rotation of 10 g. in 100 c.c. cone sugar scale.	Reducing matter calculated from Polariscope.	Difference.		Date of Manufacture.
					+	—	1880.
1	1.414	52.1	53.04	52.05	0.04	...	September 15
2	1.419	52.2	53.00	53.00	0.08	...	" 14
3	1.410	53.8	51.00	55.05	1.07	...	" 15
4	.....	53.2	55.05	49.09	....	3.3	October 12
5	1.412	51.0	54.01	51.06	0.06	...	" 18
6	1.413	51.1	53.02	52.75	1.65	...	" 19
7	1.417	51.6	53.45	52.44	0.84	...	" 19
8	1.417	49.7	55.02	50.03	0. 6	...	" 20
9	1.408	49.0	55.05	49.09	0.09	...	" 21
10	1.413	49.5	55.04	50.00	0.05	...	" 21
11	1.411	48.1	56.06	48.05	0.04	...	" 17
12	1.421	48.8	56.04	48.08	0.00	0.0	" 16
13	1.417	50.0	57.00	48.00	....	2.0	" 16
14	1.413	46.4	56.07	48.04	2.00	...	" 14
15	1.417	48 1	56.05	48.06	0.05	...	" 14
16	1.418	46.3	58.02	46.05	0.02	...	" 13
17	1.412	47.2	57.00	48.00	0.08	...	" 12
18	.....	72.0	37.03	72.63	0.63	...	Unknown.

The above analyses were of samples sent by the manufacturers, the Peoria Grape Sugar Company. They represent the whole number of samples examined and in the order in which the analyses were made. Seventeen of them were of syrups, and the eighteenth of a solid sugar. Only four out of the eighteen show discordant results. In one of these the specific gravity was not determined. It was my intention to make these four analyses in duplicate, but a press of other business prevented. In general, it appears that the results given by the polariscope, by the above method of calculation, are a little too high. If they were diminished by 5 the agreement would be better. That the reducing power of Amylose can be correctly calculated from its rotatory power is certainly established from the thirty-eight unselected instances which have been presented.

ELECTRIC LIGHT FOR LIGHTHOUSES.—The first of the series of lighthouses round the French coast which are to be henceforth illuminated by electricity, has, with all its necessary machinery, been completed. It is called the "Phare de Planier," and is situated at the mouth of the Rhone, near Marseilles.

* Read before A. A. A. S., Cincinnati, 1881.

[1] Proceedings of this Association, 1880, p. 308; Journal Am. Chem. Soc., Vol. II., p. 387.

[2] Proceedings A. A. A. S., 1880, p. 320. Journal Am. Chem. Soc., Vol. II., p. 399.

[3] Proceedings A. A. A. S., 1880, p. 313. Journal Am. Chem. Soc. Vol. II., p. 393.

[4] Proceedings A. A. A. S., 1880, p. 316. Journal Am. Chem. Soc., Vol. II., p. 395.